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INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

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GAS ABSTRACTS

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1. GAS INDUSTRY

Belgian Gas, 1952

PRODUCTION ET CONSOMMATION DU GAZ EN BELGIQUE. (PRODUCTION AND CONSUMPTION OF GAS IN BELGIUM. (1952) *Rev. générale Gaz* (Belgium) **75**, 100-101 (1953) May-June.

The annual report of The Federation de l'Industrie du Gaz en Belgique is summarized and tabulated. In 1952, gas available for distribution was 902,274,615 m^3, an increase of 3.8% over 1951. This included gas from 8,343,006 tons coal charged to coke ovens (including gas from 100 new coke ovens), 84,505,988 m^3 of coal-mine methane, cracked reformed gas from Monte-Sainte-Aldegonde, and propane-air gas. Meters in service total 1,215,288. O. P. Brysch

Fuel Choice

McCabe, J. C. FUELS—CHOICE AND HANDLING. *Chem. Eng.*, **60**, 186-189 (1953) June.

The three basic fuels, coal, oil and natural gas at present are still in ample supply, with the choice of use being determined largely by price and availability. When available, oil and natural gas find ready acceptance because of their ease of firing and simple storage and handling problems. Of the major fuels, natural gas will diminish in supply earliest. A demand for natural gas is foreseen till about 1960, after which the use of this fuel will become a poor long-range risk. Of the new fuels, nuclear energy holds possibilities of competing with coal in the near future. E. J. Pyrcioch

German Research

deHaas, E. CHEMICAL RESEARCH IN WESTERN GERMANY. *Chem. & Ind.* (British), **No. 25**, 604-609 (1953) June 20.

Various features of the organization of chemical research in Western Germany are reviewed in considerable detail. Post-war control laws applied by the Allies to prohibit research for military purposes have required semi-annual reports of all activities, to cover the categories of prohibited, approved and free research. These laws are administered by the Military Security Agency in all the allied zones. The German Ministry of the Interior sponsors and finances research and coordinates the efforts of the eleven federal states or "Lander" for their schools, clinics, institutes, libraries. Several industrial associations also promote and aid research. The various institutes promoting and conducting research, and their methods of financing, operation, policies, personnel and communications are outlined. O. P. Brysch

Gulf Coast Research

Davis, C. M. GULF COAST OPERATORS . . . MANUFACTURING SUPPLIERS . . . AND UNIVERSITIES CONTRIBUTE TO EXPANDED RESEARCH. *Oil Gas J.*, **52**, 265-268 (1953) June 22.

A listing of the research facilities of the Gulf Coast area and the fields in which specialized petroleum research is being conducted. Key personnel of the various institutions are listed. B. E. Eakin

Industrial Gas

Dotterweich, F. H. NATURAL GAS INDUSTRIALIZES SOUTH TEXAS. *Oil Gas J.*, **52**, 294, 296, 300, 306 (1953) June 22.

An analysis of the various factors involved in the industrial usage of natural gas in south Texas. Of interest is the fact that the expansion of industrial natural gas usage will possibly find its limiting factor in water availability rather than natural gas reserves. R. F. Bukacek

New Mexico Regulations

Carlson, R. F. KNOW-HOW: NEW MEXICO'S OIL AND GAS CONSERVATION PROCEDURES. *Oil Gas J.*, **52**, 84-88 (1953) June 8.

All matters relating to the conservation of oil and gas in the state are subject to the authority and jurisdiction of the New Mexico Oil Conservation Commission. The general rules of operation are divided into groups concerning: drilling, abandonment and plugging, oil-and natural-gas-production operating practices, oil-and gas-proration and allocation, secondary recovery and pressure maintenance, oil and gas purchasing and transporting, and refining. The rules are given in this report. B. E. Eakin

Northern Natural Growth

NORTHERN NATURAL GAS CO. . . . A PRODUCT OF THE DEPRESSION DAYS . . . THAT JUST GREW AND GREW. *World Oil* 137, 225 (1953) July.

Present expansion plans will increase the capacity of the system to more than a billion cubic feet per day, with the new source of supply in the Permian Basin of west Texas and New Mexico. B. E. Eakin

Technical Reports

THERE FOR THE DIGGING. *Chem. Week,* 72, 26 (1953) June 27.

The Office of Technical Services is still mailing out photostatic and microfilm copies of its more than 100,000 documents, which includes reports made by teams of U.S. and Allied investigators who visited German plants at the end of World War II. The renewed interests in these reports has resulted in the OTS going back through its files of unpublicized reels of microfilms that contain processes and technology of several firms and breaking them down into individual process reports. Many companies are making use of availability of these reports. Copies can be ordered from the Library of Congress at a cost of from 10 cents to $10 or more.

C. A. Simms

2. APPLIANCES

Burners

Brodbeck, A. H. (assigned to Magic Chef, Inc.) GAS BURNER HAVING PARTITIONED OUTLET PORTS. U.S. 2,646,112 (1953) July 21.

Dürr, W., Huber, L. and Haag, F. (assigned to Heizmotoren-Ges., Germany) BURNER DEVICE HAVING HEAT EXCHANGE AND GAS FLOW CONTROL MEANS FOR MAINTAINING PYROPHORIC IGNITION THEREIN. U. S. 2,644,512 (1953) July 7.

Lampert, A. J. and Merritt, E. A. (assigned to Rheem Mfg. Co.) GAS BURNER HEAD WITH SECONDARY AIR FEED GROOVES. U. S. 2,644,515 (1953) July 7.

Tavener, E. E. (assigned to Keith Blackman, Ltd., England) COMBUSTION CELL GAS BURNER. U. S. 2,646,113 (1953) July 21.

Locke, L. P. ROTARY GAS BURNER. U. S. 2,646,788 (1953) July 28.

Motor-driven vertical gas supply tube supports radial burner-arms, which turn slowly under cooking utensil.

Combustion Control

Haverland, F. J. ELECTRICALLY IGNITED GAS PILOT. U. S. 2,643,709 (1953) June 30.

Johnson, R. W. FUEL CONTROL. U. S. 2,643,061 (1953) June 23.

Lampert, A. J. (assigned to Rheem Mfg. Co.) FLASHBACK PREVENTION IN GAS BURNERS. U. S. 2,646,789 (1953) July 28.

Witzel, E. (assigned to Milwaukee Gas Specialty Co.) SINGLE POINT IGNITION. U. S. 2,645,280 (1953) July 14.

Cooking Appliances

de Andrade So, H. (Brazil) GAS GENERATOR FOR STOVES AND THE LIKE. U. S. 2,643,943 (1953) June 30.

Liquid hydrocarbon fuels are vaporized by pressure-controlled electrical heaters and the vapors are cracked catalytically to permanent gases, which are stored under pressure.

Mayer, C. M. (assigned to The Tappan Stove Co.) INDICATOR FOR COOKING RANGE OVENS. U. S. 2,642,132 (1953) June 16.

An electric bulb mounted on an oven panel is lit when an indicating pilot burner energizes a thermostatic element located in the rear end of the oven burner. A. R. Khan

German Appliances

Zimmer, K. DIE GASGERAETEINDUSTRIE AUF DER KOELNER FRUEHJAHRSMESSE 1953. (THE GAS APPLIANCE INDUSTRY AT THE COLOGNE SPRING FAIR 1953.) *Gas- und Wasserfach* (German) 94, 329-33 (1953) June 1.

Gas appliances exhibited by the heating and cooking industry at the February 22-24 Cologne Fair are illustrated and briefly described. Seven cooking and six room-heating appliances are emphasized. O. P. Brysch

Odor Research

BASIC ODOR RESEARCH CORRELATION CONFERENCE. *Heating, Piping and Air Conditioning*, 25, 129-131 (1953) June.

Twenty-five papers on odors, odor perception, odor control, and effects of odors were presented at the conference. Detailed abstracts of these papers are presented in this article.

C. E. Hummel

Space Heating

Fromme, E. F. CIRCULATING AIR HEATING FURNACE WITH INTERNAL AIR HEATING CONDUIT. U. S. 2,646,791 (1953) July 28.

Hodgins, W. HEATING APPARATUS. U. S. 2,643,060 (1953) June 23.

Walter, L. N. FORCED AIR FLOW AIR HEATING FURNACE. U.S. 2,642,857 (1953) June 23.

Water Heating

McFerran, F. A. WATER HEATER JACKET. U.S. 2,642,651 (1953) June 23.

3. COMBUSTION AND INDUSTRIAL FURNACES

Boiler Fuel

Worley, R. W. and Bentson, H. J. STEAM FROM STEEL. *Power Eng.*, 57, 54-57 (1953) July.

Several large boiler installations that utilize waste or by-product fuels from steel making are reviewed. With boilers burning either blast-furnace gas, coal gas or coke oven gas, enough steam is generated to supply all power and steam requirements for plant use.

G. V. Vosseller

Coal Combustion

Hammond, E. and Sarjant, R. J. HEAT RELEASE IN COAL-FIRED COMBUSTION CHAMBERS. *J. Inst. Fuel* (British) 25, 364-378 (1953) March.

The heat release from coal, burnt in a mechanically over-fired fuel bed, has been investigated in a combustion chamber in which provision was made for measuring successively along the combustion chamber. Secondary air was applied radially through high-velocity jets above the fuel bed. Means were provided for measuring the rates of air flow and combustion of fuel, gas composition, and temperature conditions in the hot gases and in the walls of the chamber. From the observed conditions, relationships were derived, for a particular fuel, between combustion space required and the following factors: rate of combustion, air/fuel ratio, and aerodynamical conditions. Coefficients of heat transfer and the effective emissivities of the flame were determined from observations, at various horizons of the combustion chamber, of the temperature and composition of the hot gases, the temperature of the surface of the combustion chamber, of the temperature and transmission to the chamber walls. The results were correlated with the combustion rate and excess air, and appropriate equations relating the variables were derived. Application of the results to a Lancashire boiler indicates that if such an appliance were fitted with over-fire jets supplying secondary air at a few inches w.g., efficient combustion could be achieved with 2 per cent excess air, and the overall efficiency of the boiler could be improved by some 8 per cent. Over a wide range of conditions of excess air and combustion rate, flame radiation accounts for 73 to 86 per cent of the total heat transfer, bed radiation for 8 to 21 per cent, and convection for 4 to 11 per cent. Authors' Abstract

Coal-Fired Engines

Moloney, J. S. SOLID FUEL FOR INTERNAL COMBUSTION ENGINES. *Eng. Digest* (British), 14, 215-17 (1953) June.

Satisfactory performance of the internal combustion engine operating on pulverized coal is governed by the fuel particle-size and the relative movement between the solid particles and the fluid in which they are carried. A laboratory study of the relation between the velocity of a coal particle and the frictional forces was made for different coal particle sizes. The results show that for an increase in the absolute velocity of a flow system, relative motion between dust particles and the fluid is decreased. The indication is that the wear and clogging due to fuel particles in a solid fuel engine would decrease as the engine speed increases.

E. J. Pyrcioch

Flue Gas Sulfur

Widell, T. FORMATION OF SULFUR TRIOXIDE IN FLUE GAS. *Combustion*, 24, 53-55, (1953) June.

A review of the conclusions of different investigators as to the manner in which sulfur trioxide is formed from oxidation of SO_2. Calculations as to the rate of SO_3 formation and curves showing the influence of certain factors are included. Author's Abstract

Free-Piston Turbine

FREE-PISTON GAS TURBINE. *Chem. Eng.*, 60, 206, 207 (1953) July.

An elementary discussion of the gas turbine prime mover driven by exhaust gas from a free-piston engine. The high thermal efficiency of the diesel engine coupled with turbine prime mover characteristics makes this cycle attractive. Reviewer believes the disadvantages of this arrangement are not generally understood, and lists a few as follows: 1) the mechanical problems of the free-piston engine are formidable, 2) the benefits of simplicity, low maintenance, use of low-grade fuel for the pure turbine cycle are lost, 3) the arrangement is at best an intermediate step, awaiting the high-efficiency gas turbine to be achieved in the not-too-distant future when blades will be cooled to withstand high temperature, either by the continuous action of cooling fluid, or more probably by cyclic cooling, the same principle which permits cylinder walls to withstand the high temperature in the internal combustion engine.

P. R. Trumpler

Gas Turbine

DESIGN AND DEVELOPMENT OF A PRODUCTION GAS TURBINE. *Gas Oil Power* (British) 48, 140-144 (1953) June.

Article describes the 1000 kw Ruston TA production-line gas turbine designed to provide power for electricity generation, crude oil pumping, and generating installations combined with the provision of heat for industrial processes. Mechanical arrangement of the unit is standard, with a 13-stage axial compressor, elbow combustion chamber, two pairs of turbine wheels in series driving the twin shafts, and a recuperator (optional). The turbine has been designed to drive through a standard gearbox to provide different output speeds including 1500 and 1800 rpm, suitable respectively for 50 cycle and 60 cycle alternators, while a direct drive from the turbine can also be provided at 6000 rpm. Thermal efficiencies and turbine inlet gas temperatures are not given.

P. R. Trumpler

Gas Turbine Regenerators

Harper, D. B. and Rohsenow, W. M. EFFECT OF ROTARY REGENERATOR PERFORMANCE ON GAS TURBINE-PLANT PERFORMANCE. *Am. Soc. Mech. Engs. Trans.*, 75, 759-765 (1953) July.

Bowden, A. T. and Hryniszak, W. THE ROTARY REGENERATIVE AIR PREHEATER FOR GAS TURBINES. *Am. Soc. Mech. Engs. Trans.*, 75, 767-777 (1953) July.

Coppage, J. E. and London, A. L. THE PERIODIC-FLOW REGENERATOR — A SUMMARY OF DESIGN THEORY. *Am. Soc. Mech. Engs. Trans.*, 75, 779-787 (1953) July.

The first article is a theoretical study of effect of leakage and pressure drop in a rotary regenerator (similar to Ljungström air preheater) on gas-turbine-plant performance, and demonstration of effect of regenerator dimensions and speed. In the second article the authors discuss particularly the solution of practical design problems dealing with general apparatus arrangement, choice of regenerator matrix, and type of seals. The authors of the third article recommend a simplified calculation procedure for sizing a regenerative exchanger. Reviewer believes that the rotary regenerator had doubtful economic advantage in stationary gas turbine power plants; permitting air leakage in the heat recovery apparatus to the degree at present necessary in a rotary regenerator is costly. In a $500,000 gas turbine plant the exhaust heat exchanger represents perhaps 10% to 15%. Thus it might require $50,000 investment in additional plant capacity to counteract regenerator leakage, in which case purchaser could afford to pay $50,000 more for a leak-proof heat transfer device than for rotary regenerator. This excludes the regenerator from economic consideration. Only greatly improved sealing methods will change this picture. The possible saving of space with a rotary regenerator would be of greater interest for aircraft

power than for large stationary installations. Another advantage, the possible use of a ceramic regenerator matrix for passing high temperature gas, appears to be of no great significance for stationary units in the near future.

P. R. Trumpler

Nuclear Power

INDUSTRY POINTS WAY TO NUCLEAR POWER. *Mech. Eng.*, 75, 481-485 (1953) June.

A study of the technical and economic aspects of nuclear power generation by four different industry groups indicates that nuclear reactors for power generation are possible in size with four utility power companies. Such plants could be built within five years and designed so as to produce fissionable material for weapons or for power production. The economics is still uncertain but considered to be within a range of present costs of steam power. Brief descriptions are given of the reactor designs proposed by the four groups.

E. J. Pyrcioch

4. CARBONIZATION AND GASIFICATION

Byproduct Recovery

CHEMICALS FROM COKE-OVEN GASES: CURRENT AND FUTURE TRENDS EXAMINED. *Chem. Process Eng.* (British), 34, 168-170 (1953) June.

The latest practices in extracting by-products from coke oven gases are described and some pointers to greater economy are given. The complete gasification of coal under pressure and the recovery of the sensible heat of the coke will improve the economy.

I. P. Patel

Coal Hydrogenation

Chaffee, C. C. and Hirst, L. L. LIQUID FUEL FROM COAL: PROGRESS REPORT ON HYDROGENATION DEMONSTRATION PLANT. *Ind. Eng. Chem.*, 45, 822-838 (1953) April.

A detailed presentation of pilot plant design and experimental coal hydrogenation results are presented for both liquid phase and vapor phase operation using Illinois, Kentucky and Wyoming coals. Yield data and analyses of feeds and products are included.

C. G. von Fredersdorff

COAL HYDROGENATION CHEMICALS PLANT. *Chem. Process Eng.* (British) 34, 165-168 (1953) June.

A commercial-size experimental coal hydrogenation plant of the Carbide and Carbon Chemicals Co. at Institute, West Virginia is described. The plant was designed to process 300 tons/day of coal and to operate at 10,000 psi pressure to produce aromatic chemicals. The operating process is claimed to be superior to the uneconomical German process which was used primarily for motor fuel production. Hydrogenation is conducted entirely in the liquid phase.

E. J. Pyrcioch

Coal Mineral Matter

Flint, D. THE TOTAL MINERAL MATTER IN COAL AND ITS INFLUENCE UPON COAL CLASSIFICATION. *Brit. Coal Utilis. Res. Assoc. Monthly* 17, 133-142 (1953) April.

This reviews the methods for determining the total mineral matter content of coal, a fundamental requirement for most coal classifications. At present, no method is available for the precise determination of total mineral matter. Information already obtained is largely in the form of semi-empirical formulas based on total ash, its chemical analysis, and petrographical identification of associated coal minerals, from which total mineral matter is estimated.

D. J. Dennison

Coal Moisture

Lyons, O. R. REDUCING THE MOISTURE CONTENT AND LARGE MOISTURE VARIATIONS IN RUSSELLTON WASHED COAL. *Mining Eng.*, 5, 614-19 (1953) June.

Thick Freeport seam coal, 3½ × 0 in., was washed in a Chance cone and the ¼ × 0 in. on Deister tables at about 400 tons/hr. The first size is dewatered on shaking screens and the fine size in Bird centrifuges, and the washed products recombined. By modifying the feed ports and baffles, and adding a 2-in. stream of water (70 gpm) to obtain a classifying and desliming action in the centrifuge, the moisture in the fines was reduced from 13.97% to 11.48%. The ash content was also reduced by about 0.5%, but the wear on the centrifuge spiral was increased. Thus a satisfactory

(1.57%) moisture reduction was obtained in the mixed product going to the coke ovens.

O. P. Brysch

Coke Ovens

Hughes, C. H. (assigned to Hughes By-Product Coke Oven Corp.) COMBUSTION CONTROL DEVICE FOR SOLE-FIRED HORIZONTAL COKE OVENS. U. S. 2,640,805 (1953) June 2.

An improved broad coke oven is claimed, in which better yield and quality of aromatic hydrocarbons are obtained by pyrolysis of petroleum or coal. A novel feature is the divided recuperator system of silicon carbide, which preheats the air for the heating flues. Top heating flues in the roof of the oven are provided for vapor cracking. O. P. Brysch

Effluent Liquors

Priestley, J. J. GASWORKS LIQUORS. *Gas J.* (British) **275**, 39-40 (1953) July 1.

The nature and composition of liquid effluents from gas works, and their improvement by changes in gas production methods and by subsequent treatment are discussed.

D. M. Mason

Gasification with Oxygen

Strimbeck, G. R., Cordiner, J. V., Jr., Taylor, H. G., Plants, K. D. and Schmidt, L. D. PROGRESS REPORT ON OPERATION OF PRESSURE-GASIFICATION PILOT PLANT UTILIZING PULVERIZED COAL AND OXYGEN. U. S. Bureau of Mines Rept. Inv. 4971 (1953) May.

Detailed design and operating results are presented for the gasification of 200-mesh pulverized coal in suspension with oxygen and steam in a pressure pilot unit operating at 100 to 300 psig. The gasifier operated with downward injection of coal and superheated oxygen-steam mixtures in a combination burner, followed by rapid water quenching of reaction products at the outlet of the gasification zone. A fluidized coal-charge vessel facilitated feeding of the fuel at a uniform rate. Average operating results indicate reactant requirements per MCF CO plus H_2 generated to be 35-38 lb. coal, 340-360 SCF oxygen and 10.5-11.5 lb. steam. Carbon gasification efficiencies ranged from 75 to 97 per cent, depending on the oxygen-coal input ratio. The coal-throughput rate per unit volume of gasification space appeared to vary directly with the operating pressure; rates of 125-485 lb. coal per CF being obtained at pressures of 100-300 psig. C. G. von Fredersdorff

Germanium Recovery

GERMANIUM. *Chem. Process Eng.* (British), **34**, 175-179 (1953) June.

The American and British production processes for the extraction of germanium from flue dusts, germanite, and zinc sulfide ores are described and illustrated. The major use of germanium is in the semi-conductor field for the manufacture of diodes and transistors. Current research on applications of germanium is discussed. D. J. Dennison

Lignite Gasification

Chetrick, M. H. THERMAL REQUIREMENTS FOR THE GASIFICATION OF LIGNITE IN AN EXTERNALLY HEATED RETORT. U. S. Bureau Mines Rept. Inv. 4957 (1953) March.

Graphical correlations are presented for the thermal input per unit volume of wet gas produced in an externally-fired continuous oil shale retort located at Grand Forks, N. Dak. The cold thermal efficiency based on the heating value of vaporized and cracked hydrocarbon products varied from 45 to 65% depending on the steam decomposition, with heat input requirements on the order of 25 to 120 Btu/SCF wet gases. The results correlated with

$$\triangle H = 148/(H_2/CO)^{0.135}$$

where H_2/CO is the hydrogen-carbon monoxide ratio in the product gas and $\triangle H$ is the heat input, Btu/SCF dry gas produced.

C. G. von Fredersdorff

Solids Feeders

Daniels, J. (assigned to Koppers Co. Inc.) APPARATUS FOR PREPARING A SUSPENSION OF FINELY DIVIDED SOLID IN A GASEOUS MEDIUM. U. S. 2,621,083 (1952) December 9.

A unique spiral feeder is described which has a tapered discharge end suitable for continuous formation of suspensions of finely divided solids. C. G. von Fredersdorff

Water Gas

Williams, N. H., England (assigned to Humphreys and Glasgow, Ltd.) APPARATUS FOR CARBURETED WATER GAS. U. S. 2,639,228 (1953) May 19.

A carbureted water gas set designed for use with heavy oil and employing a carbureter with no checkerwork is described.

E. J. Pyrcioch

Wet Purification

Wilkes, J. E. and Bell, J. A. SOME ATTEMPTS MADE TO REDUCE THE COST OF GAS PRODUCTION—PART II. *Gas World* (British), 137, 1791-1794 (1953) June 27.

Process improvements in a liquid gas purifying plant of the water washing type are described.

D. M. Mason

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Automatic Shutdown Valves

Proper, G. PRESSURE-RATE-DROP SETTINGS FOR AUTOMATIC SHUTDOWN DEVICES ON GAS PIPE-LINE VALVES. *Oil Gas J.*, 52, 234-238 (1953) June 22.

A recent Transcontinental Gas Pipe Line Corp. check on safety shutdown devices is discussed. The devices used were of two similar types, one distributed by the M. S. Crose Co., Inc. and the other a Transco design utilizing an oil-field-type choke nipple. A description of operation and diagram is given for both shutdown devices. Pressure-rate drop charts are illustrated that enable determination of rate settings for a full line break or shutdown of upstream compressor station. These charts were developed from the Panhandle formula and a few simplifying assumptions. Results from Transco's experiment show that the control units on shut-down devices should require a 25psia drop per minute in order to not detect minor leaks or operation changes.

R. A. Bambenek

Cycling Research

Swearingen, J. S. HOW CYCLING WORKS TO ACHIEVE MAXIMUM RECOVERY. *Oil Gas J.*, 52, 283-285 (1953) June 22.

A mathematical analysis for calculating the distribution of fluids in sand packed tubes is made. The effects of variable permeability and thickness are shown graphically.

D. C. Gami

Drilling Contracts

Bell, A. H. WHAT THE DRILLING CONTRACTOR OFFERS TO THE OIL INDUSTRY. *Cal. Oil World*, 46, 1, 2, 4, 6 (1953) June 1.

A presentation by an independent drilling contractor defending the position of production companies contracting their drilling instead of maintaining their own rigs and crews.

B. E. Eakin

Gas Conditioning

Pearce, K. G. NEW McKAMIE PROCESSING FACILITIES OPERATING AT 50 MILLION CUBIC FEET DAILY. *Oil Gas J.*, 52, 152-155 (1953) May 25.

The enlarged McKamie plant which began operation in April 1951 is designed to sweeten gas and liquids, to stabilize distillate, to recover natural gasoline and LP-gas, and to dehydrate and inject gas back into the adjacent McKamie-Patton pool.

D. M. Mason

New Hugoton Field

Ingalls, P. GREATEST GAS AREA GROWS BIGGER. *Oil Gas J.*, 52, 187 (1953) June 15.

The search for oil and gas in Southwest Kansas and the Oklahoma Panhandle has resulted in the discovery of two new fields to the south west of the Hugoton gas field. The discoveries are increasing in number, indicating a possibly large new field of oil and gas near the greatest present gas area.

B. E. Eakin

Phase Behavior

Donnelly, H. G. and Katz, D. L. PHASE EQUILIBRIA IN THE CARBON DIOXIDE-METHANE SYSTEM. Research Conf. on Phase Behavior of The Hydrocarbons, Univ. of Michigan, Ann Arbor, (1953), July 1-2.

The phase compositions were determined for the carbon dioxide-methane system between the critical locus and minus 100°F. The critical

locus and vapor-liquid equilibria down to the triple point for carbon dioxide are normal. The univariant vapor-liquid-solid carbon dioxide equilibria curve shows a high maximum, intruding on the normal vapor-liquid equilibrium region. The data are correlated to show phases and their compositions at all pressures for temperatures down to minus 150°F.

Authors' Abstract

Gami, D. C. and Patel, I. P. PHASE BEHAVIOR STUDIES AT THE INSTITUTE OF GAS TECHNOLOGY. Research Conf. on Phase Behavior of the Hydrocarbons Univ. of Michigan, Ann Arbor (1953), July 1-2.

A general outline of the equipment used to determine the phase equilibria and PVT relationship of hydrocarbon binaries is given. Equations for calculating thermodynamic properties in the two-phase and gas-phase regions are derived. These equations are based on the Benedict-Webb-Rubin type of equation of state.

D. C. Gami

Hanson, G. H., Hogan, R. J., Ruehlen, F. N. and Cines, M. R. ETHANE-ETHYLENE SYSTEM VAPOR-LIQUID EQUILIBRIUM RELATIONSHIPS AT 0, -40 AND -100 F. Research Conf. on Phase Behavior of the Hydrocarbons, Univ. of Michigan, Ann Arbor (1953), July 1-2.

Isothermal vapor liquid equilibria for ethane ethylene mixtures are determined at 0, -40 and -100 F. These data are smoothed using activity coefficients which obey the Gibbs- Duhem relationship.

D. C. Gami

Kay, W. B. and Donham, W. EFFECT OF MOLECULAR STRUCTURE UPON CRITICAL PHENOMENA. Research Conf. on Phase Behavior of the Hydrocarbons, Univ. of Michigan, Ann Arbor (1953), July 1-2.

Liquid-vapor phase boundary curves for the binaries isobutanol-n-butanol, methanol-n-butanol and ethyl ether-n-butanol are determined. The methanol-n-butanol system shows the greatest difference in phase behavior from the non polar methane-n-butane system in the relations of the critical temperature and pressure with composition. The maximum deviation from a linear mole relationship is only $\frac{1}{15}$ as large as the corresponding deviation in the methane-n-butane system.

D. C. Gami

Organick, E. I. APPLICATION OF PHASE EQUILIBRIUM DATA IN THE STUDY OF A RICH CONDENSATE-GAS RESERVOIR. Research Conf. on Phase Behavior of the Hydrocarbons, Univ. of Michigan, Ann Arbor (1953), July 1-2.

With the help of the complete production records and the laboratory data on a rich condensate field in the Gulf coast area of Texas, a study is made to determine how much liquid if any forms by retrograde condensation in the reservoir. Liquid begins to flow to the well bore in appreciable quantities when accumulation of the liquid phase reaches approximately 20% by volume of the pore space open to hydrocarbons.

D. C. Gami

Selleck, F. T., Opfell, J. B. and Sage, B. H. APPLICATION OF THE BENEDICT EQUATION OF STATE FOR PROPANE. Research Conf. on Phase Behavior of the Hydrocarbons, Univ. of Michigan, Ann Arbor (1953), July 1-2.

See *Gas Abstracts* **9**, 147 (1953) August.

Williams, R. B. and Katz, D. L. VAPOR LIQUID EQUILIBRIA IN BINARY SYSTEMS OF HYDROGEN WITH ETHYLENE, ETHANE, PROPYLENE AND PROPANE. Research Conf. on Phase Behavior of the Hydrocarbons. Univ. of Michigan, Ann Arbor (1953), July 1-2.

Experimental data are presented for binary systems of hydrogen with ethylene, ethane, propylene, and propane at temperatures from -300°F to 75°F and at pressures from 250 to 8000 pounds per square inch. The critical pressures were approached for those mixtures which contained high concentrations of the hydrocarbon. Hydrogen has the reversed solubility for most of the conditions studied but does show normal solubility when the hydrocarbon concentration in the vapor reaches an appreciable concentration. Six ternary equilibria serve as a basis for interpolating hydrogen equilibrium constants in complex mixtures.

Authors' Abstract

Purification

Leutz, K. E. (assigned to Sun Oil Co.) GAS PURIFICATION. U.S. 2,641,526 (1953) June 9.

A regenerative washing process for selective removal of H_2S in the presence of CO_2 using an aqueous pH in the range of 4 to 7 is claimed. The treating agent is regenerated with air to yield free sulfur. D. M. Mason

Leutz, K. E. (assigned to Sun Oil Co.) RECOVERY OF SULFUR FROM GASES. U. S. 2,641,527 (1953) June 9.

Selective removal of hydrogen sulfide from gases which also contain carbon dioxide is accomplished in this cyclic process by contacting such mixtures with aqueous solutions of soluble iron salts such as ferrous acetate. Concentrations of the reagent within the range of 50-200 grams per liter, and pH values of 4 to 7 have been found suitable. Regeneration of the absorbent is effected by contacting the solution with air. Free sulphur formed in this step is then removed from the absorbent by filtration or settling. C. E. Hummel

Well Corrosion

Nelson, J. W. (assigned to Sinclair Oil and Gas Co.) PREVENTION OF CORROSION. U. S. 2,640,809 (1953) June 2.

A method of corrosion prevention comprising the addition of small amounts of oxidized microcrystalline wax to the well fluid claims a reduction in the rate of corrosion. B. E. Eakin

Well-Flow Correlations

Poettman, F. H. and Carpenter, P. G. NEW CORRELATION SIMPLIFIES PRESSURE GRADIENT CALCULATION IN TUBING. *World Oil*, 136, 161-164, 166, 175 (1953) June.

A correlation has been developed from Bureau of Mines data on flowing oil wells and Phillips Petroleum Company data of flowing oil wells and gas lift wells. It is said to be useful in designing gas lift installations, locating injection depth, determining injection rate and horsepower requirements, and the effect of production rate and tubing size. R. F. Bukacek

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Carlson, R. F. NEW MEXICO'S OIL AND GAS PROCEDURES. p. 153

Carr, N. L. VISCOSITIES OF NATURAL GAS COMPONENTS AND MIXTURES. p. 165

Stark, D. J. NATURAL GAS TO ETHANE TO ETHYLENE. p. 168

BASIC ODOR RESEARCH CORRELATION CONFERENCE. p. 155

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Acidizing

Cardwell, P. H. and Lunsford, C. L. (assigned to The Dow Chemical Co.) TREATMENT OF WELLS. U. S. 2,640,810 (1953) June 2.

When acidizing calcareous formations containing silicates capable of swelling due to the presence of the spent hydrochloric acid, this claims an improved method using a buffer solution of formic acid or the salts of formic acid to prevent the swelling. B. E. Eakin

Cracking Process

Findlay, R. A. (assigned to Phillips Petroleum Co.) DEVICE AND PROCESS FOR CONVERTING HYDROCARBONS. U. S. 2,643,2;6 (1953) June 23.

A moving bed cracking process, similar to the TPC process for heavy residual oils is described in which cyclic operation is employed to keep the product offtake free of coke deposit. Function of the reaction and regenerator are periodically reversed so that deposited coke is burned out with air during the heating portion of the cycle. J. M. Reid

Desulfurization

Porter, F. W. and Northcott, R. P. (assigned to Anglo-Iranian Oil Co.) PROCESS FOR RECOVERY OF SULFUR FROM SULFUR-CONTAMINATED METALLIC CATALYSTS. U. S. 2,643,939 (1953) June 30.

Sulfur is recovered from metallic oxide catalysts used in desulfurization processes by pass-

ing an air-steam mixture over the catalyst at 1100° F. The gases are cooled to about 70° F and the sulfur is collected in a settling tank.

C. E. Hummel

Fischer-Tropsch

Hill, L. R. and McGrath, H. G. (assigned to The M. W. Kellogg Co.) SYNTHESIS OF ORGANIC COMPOUNDS. U. S. 2,640,843 (1953) June 2.

An improvement is claimed in the synthesis of organic compounds of more than one carbon atom per molecule by hydrogenation of carbon monoxide over fluidized iron catalyst, consisting of limiting contact to 2.5 cubic feet of carbon monoxide per pound of catalyst circulated. Maintaining optimum catalyst activity and eliminating the necessity of catalyst regeneration are expected. J. M. Reid

McGrath, H. G. and Hill, L. R. (assigned to The ESS FOR SYNTHESIS OF ORGANIC COM- M. W. Kellogg Co.) HIGH VELOCITY PROC- POUNDS. U. S. 2,640,844 (1953) June 2.

An improved fluidized method is claimed for hydrogenation of carbon monoxide to yield organic compounds of more than one carbon atom per molecule. Linear velocities of 5 to 40 feet per second are employed in the reaction zone producing lean phase fluidization of the catalyst. Catalyst concentrations of from 1 to 18 pounds per cubic foot are attained allowing the use of hydrogen to carbon monoxide ratios as low as 0.7 to obtain yields similar to other synthesis processes. Better temperature control and less wax accumulation are also claimed.

J. M. Reid

Fluidized Syntheses

Beck, R. A. and Sensel, E. E. (assigned to The Texas Co.) HYDROCARBON SYNTHESIS. U. S. 2,640,845 (1953) June 2.

An invention for better contact of gaseous reactants and fluidized catalysts in fluidized beds to promote conversion and heat transfer is described. G. V. Vosseller

Formation Fracturing

Clark, R. C., Freedman, H. G., Bolstad, J. H., and Coffer, H. F. HAVE YOU TRIED HYDRAULIC FRACTURING TO INCREASE PRODUCTION? *Oil Gas J.*, 52, 78-80 (1953) June 29.

Hydraulic fracturing may be used for: increased drainage area, break-through of permeability blocks at well bore, and break through to a permeable oil-saturated zone. Best results generally are obtained when fracturing sandstones or conglomerate, and occasionally limestones and dolomites. Viscous crudes and refined oils with sand have recently had wide application as fracturing fluids. Better results have been obtained when fracturing through perforations in casing instead of through open hole. One fracture for every 20 to 40 feet of formation, depending on permeability, is considered optimum. A review of 23 wells in the North Texas area revealed an average increase of 434 per cent for wells treated through perforations, and 167 per cent for wells treated in open hole sections. B. E. Eakin

Hydrogenation

Hoffmann, E. J. and Wadley, E. F. (assigned to Standard Oil Development Co.) HYDROGENATION OF NAPHTHAS. U. S. 2,638,438 (1953) May 12.

A process is described for selectively hydrogenating diolefins in olefin-containing naphthas, in which 0.1 to 1% of mercaptan or thiophenol is added to the naphtha before subjecting it to catalytic treatment. After the catalytic treatment, residual organic sulfur compounds are removed by caustic washing. D. M. Mason

Oil Transportation

Boice, J. E. SHIFTS IN PETROLEUM TRANSPORTATION. *Petroleum Eng.*, 25, D-13, 15, 17 (1953) July.

Changes taking place in the movement of crude oil and refinery products from 1938 to 1950 are discussed and graphs presented. All carriers but railroads have increased their volume transported in the last 13 years. Percentages show the railroads to have lost this volume mainly to truck transportation. H. A. Dirksen

Shale Oil Retort

Carr, J. W., Jr. and Griffin, L. I., Jr. and Nicholson, E. W. S. (assigned to Standard Oil Development Co.) FLUIDIZED DISTILLATION OF OIL-SHALE. U. S. 2,643,219 (1953) June 23.

In conventional fluid-type, two-vessel shale retorting, difficulties arise due to rapid disintegration of the shale particles. Also some shale particles are highly resistant to attrition. This leads to a wide particle size distribution and poor fluidization qualities. The patent claims an improved means for controlling the particle size. This is to be done by selective elutriation with the fluidizing gas in the combustion vessel. Undesirably small particles are removed overhead and large particles downwardly, simultaneously. If necessary, extraneous solids of proper particle size may be introduced to establish proper size concentration of fluidized solids. About 25 to 50 per cent of 60 to 200 micron size is considered desirable. Also claimed are improved product qualities if the extraneous solids introduced are cracking catalysts.

E. B. Shultz, Jr.

Nicolai, L. A. (assigned to Standard Oil Development Co.) FLUID-TYPE SHALE RETORTING. U. S. 2,643,218 (1953) June 23.

In conventional fluid-type two vessel shale retorting, the burned shale fines returned to the retort vessel tend to adsorb carbon deposits there. This carbon is subsequently burned off in the heater vessel, causing loss of organic content of the shale. It is claimed that this loss is greatly reduced by treating the hot, spent shale fines with a reducing gas, prior to returning the fines to the retort as the fluidized heat transfer medium. The fines then adsorb much less carbon while moving through the retort. Hydrogen and methane are used at 900°-1200°F for contact times of one to ten minutes.

E. B. Shultz, Jr.

Wells, W. E. and Ruark, J. R. PILOT-PLANT BATCH RETORTING OF COLORADO OIL SHALE. U. S. Bureau Mines Rept. Inv. 4874 (1952) May.

Operating results using Colorado oil shale in an intermittently charged retort, which was heated by internal circulation of preheated gases, showed oil recoveries ranging from 90 to 100 percent of Fischer assay (up to 50 gal. oil/ton shale) with simultaneous production of 300-Btu combustible gases in ratios of 1600 to 2100 SCF/ton shale. Superheated steam, preheated shale gas and flue gas appeared to be equally satisfactory as heat transfer media. The retort became inoperable with oil shale having an assay greater than 50 gal/ton, due to swelling and caking of the solid residue.

C. G. von Fredersdorff

Shale Oil

Sanderson, R. T. (assigned to The Texas Co.) TREATMENT OF SHALE. ZoBell, C. E. (assigned to Texaco Development Corp.) RECOVERY OF HYDROCARBONS. U. S. 2,641,565, 2,641,566 (1953) June 9.

Microbiological methods of separating oil from oil shale are described. Shales or oil sands may be treated at room temperatures with various micro-organisms, specifically hydrogenase producing bacteria in presence of hydrogen, which metabolize certain constituents of the kerogen content of the shale. This releases the oil and lowers its viscosity. Many suitable molds and bacteria, nutrient mediums and substrates are described. It is claimed that the process may also be applied to treating shales, or such deposits as the Athabaska oil sands, in their original formations in the ground. Also claimed is an improved secondary recovery method for petroleum. Water used for flooding may be suitably inoculated, then microbiological action may effect greater oil release and lower oil viscosity.

E. B. Shultz, Jr.

Horne, J. W. and Tisot, P. R. (assigned to the United States of America) RECOVERY OF WAXES FROM SHALE OIL. U. S. 2,642,380 (1953) June 16.

Both olefinic and paraffinic waxes may be recovered from shale oil, according to this patent. Although they are not found in petroleum, high melting point waxes with olefinic unsaturation may be recovered from shale oil produced by pyrolytic decomposition of organic material in oil shale. Usual solvent extraction methods are applied to high boiling (675°-950°F) shale oil fractions to remove both olefinc and paraffinic waxes. The usual manner of refining petroleum waxes with acids would then eliminate

the olefins and use quantities of acids; so it is claimed that adsorbents, such as silica gel, may be used to preferentially adsorb the olefinic waxes. This is followed by desorption with a solvent such as cyclohexanol, thus separating the olefinic from the paraffinic waxes.

E. B. Shultz, Jr.

Synthesis Gas

Gee, W. P. (assigned to Texaco Development Corp.) GENERATION OF SYNTHESIS GAS. U. S. 2,630,378 (1953) March 3.

The patent refers to a dual stage process for the generation of synthesis gas of a high H_2/CO ratio whereby vaporized liquid hydrocarbons are gasified by partial combustion in oxygen with steam, and the residual deposited carbon is completed gasified by a second partial combustion-steam reaction. C. G. von Fredersdorff

SWITCH IN SYNTHESIS. *Chem. Week*, **72**, 36, 38 (1953) June 6.

A description is given of a new process to make synthesis gas which will replace coke ovens and gas generators at Du Pont's Belle (West Virginia) Works. R. Parker

7. ANALYTICAL METHODS AND TESTS

Chromatography

Eby, L. T. PROPERTIES OF HIGH BOILING PETROLEUM PRODUCTS. *Anal. Chem.*, **25**, 1057-1060 (1953) July.

A rapid method for the determination of the composition of petroleum products boiling above 600°F is discussed. An elution method with silica gel adsorbent and three selective solvents is employed. Nonaromatic, aromatic, and oxy fractions are obtained. E. Mann

James, D. H. and Phillips, C. S. THE CHROMATOGRAPHY OF GASES AND VAPOURS. *J. Chem. Soc.* (British) 1600-1610 (1953) May.

An apparatus is described for the analysis and separation of mixtures of volatile substances by the use of chromatographic methods in which the moving phase is a gas. Separations of close-boiling mixtures, such as n-butyl alcohol (bp 117°) and pyridine (115°), and of members of the same homologous series, as propyl acetate from butyl acetate and n-hexane from n-heptane, can be made. Quantitative analyses can be made with an accuracy of 1 per cent.

D. M. Mason

H_2S Determination

Riesenfeld, F. C. and Orbach, H. K. METHODS FOR DETERMINING HYDROGEN SULFIDE IN GASES. *Petroleum Eng.*, **25**, C32, C34-C38 (1953) June.

A critical evaluation of conventional analytical methods for determining hydrogen sulfide in gases is presented. Instrumental methods are reviewed. Interferences encountered in analyzing various types of gases are discussed.

C. E. Hummel

Recording Analyzer

Clamann, H. G. THE PNEUMATIC REFRACTOMETER A CONTINUOUS FAST RECORDING GAS ANALYZER. *Instruments*, **26**, 740-742 (1953) May.

The refractive index of a pure gas varies with its density or, in a mixture of gases with components of different refractive indices, with its concentration. The gas mixture to be analyzed is forced by constant flow to form a well defined band imbedded in a suitable reference gas. A light beam passing from the reference gas into the analyzed gas is refracted according to changes in its composition, therefore more or less spread out, thus changing the brightness of an image. These changes are transmitted by photocell and amplifier to an indicating or recording device. Author's Abstract

Sulfur Determination

Francis, C. B. APPARATUS FOR DETERMINING CARBON AND SULFUR. U. S. 2,639,980 (1953) May 26.

An apparatus and method for determining carbon and sulfur in steel are described.

D. M. Mason

Mott, R. A. and Wilkinson, H. C. THE USE OF THE ESCHKA METHOD FOR THE DETERMINATION OF HIGH SULPHUR CON-

TENTS. *J. Appl. Chem.* (British) **3**, 218-223 (1953) May.

It is shown that the incineration period for determining sulphur in coal can be reduced, in a well ventilated muffle, to 1 hour at 775-800°, for a 1-g. sample with 4 g. of Eschka mixture. The same time can be used for high sulphur contents with 0.1-g. samples. The essential feature in obtaining complete precipitation of the sulphate ion is to ensure adequate excess of barium chloride. It is shown that the barium sulphate precipitate is most quickly and accurately determined by igniting the wet filter-paper in a well ventilated muffle, with precautions to avoid shock-heating.

Authors' Abstract

Shively, J. H. and Levin, H. HOW TO OBTAIN FREE SULFUR IN LPG. *Petroleum Processing* 8, 913 (1953) June.

Free sulfur may be present in significant concentrations in refinery LPG. Its determination by evaporation of the LP-gas, solution of the residue in sulfur-free gasoline, shaking the gasoline with mercury, and estimating the turbidity of the mercury sulfide, is described.

D. M. Mason

8. GENERAL AND PHYSICAL CHEMISTRY

Ammonia Properties

Hildenbrand, D. L. and Giauque, W. F. AMMONIUM OXIDE AND AMMONIUM HYDROXIDE. HEAT CAPACITIES AND THERMODYNAMIC PROPERTIES FROM 15 TO 300°K. *J. Am. Chem. Soc.* 75, 2811-2818, (1953) June 20.

Thermodynamic properties of ammonium hydroxide and ammonium oxide from 15 to 300°K were determined by calorimetric measurements. This third law data was then compared with free energy data for reactions of water, ammonia, and ammonium hydroxide. D. M. Mason

Diffusion Separation

Huckins, H. E. and Kammermeyer, K. THE SEPARATION OF GASES BY MEANS OF POROUS MEMBRANES. *Chem. Eng. Progress*, **49**, 294-298 (1953) June.

Based on experiments with porous glass media the separation that was obtained agreed fairly well with calculations using the experimental values of permeability, even though the ratio of experimental permeabilities differed from the theoretical ratio of molecular weights.

G. V. Vosseller

Equilibria

Whiteway, S. G. and Mason, S. G. COEXISTENCE PHENOMENA IN THE CRITICAL REGION. II. INFLUENCE OF GRAVITY ON THE COEXISTENCE CURVES OF ETHANE, ETHYLENE, AND XENON. *Can. J. Chem.*, **31**, 569-584 (1953) June.

Liquid-vapor coexistence curves of ethane, ethylene, and xenon have been measured in the region of the critical point. Impurities present in the ethane and ethylene gave retrograde systems; reduction of the impurities yielded coexistence curves which were flat along the temperature axis to 0.001°C. When the height of the ethylene system was decreased the range of densities over which the curve was flat was diminished. Stirring of the system caused the curve to be rounded. Similar results, confirming those of Weinberger and Schneider, were obtained with xenon. The observed behavior is in good agreement with the hypothesis that the major part of the flat top effect is due to gravitational compression. Authors' Abstract

Gas Viscosities

Carr, N. L. VISCOSITIES OF NATURAL GAS COMPONENTS AND MIXTURES. Institute of Gas Technology (Chicago) Research Bulletin 23, (1953) June.

This Bulletin presents a literature survey, the laboratory equipment design, experimental techniques, the experimental data, and correlations, for the determination of the absolute viscosity of methane and three natural gas mixtures at pressures up to 10,000 pounds per square inch and temperatures from 70° to 250F. Due to the high pressures involved, the viscometer was enclosed in a special bomb in which the temperature and pressure were accurately controlled and measured. Two Pyrex viscometers of the Rankine type were con-

structed and used in this investigation. Each viscometer consisted of a relatively long, small-bore, capillary tube modified for high-pressure use. Gases were admitted to the viscometer and forced through the capillary tube under laminar flow conditions. Viscosity-pressure isotherms were prepared for methane and three natural gas mixtures. The diagrams show the effect of temperature, pressure and composition on the viscosity of these gases. These data were correlated in a simple manner in the form of reduced charts, so that the viscosity of gas mixtures and non-polar gases can be estimated at any temperature and pressure within the limitations of the correlations. An alternate method for estimating high-pressure viscosities of gases and gas mixtures was developed, and compared with experimental values and found to be remarkably accurate. This method utilized the analogy between the viscosity and kinetic pressure, the latter calculated from an accurate equation of state.

The viscosity data obtained were compared with accurate published data withi the ranges covered by the latter, and found to be in excellent agreement. On the reliability of the data it is concluded that the maximum error is within one percent in most cases, and within two percent for the remainder. Internal consistency and reproducibility of the data were very satisfactory, with use of the two viscometers and repeated measurements. Author's Abstract

Granet, I. CALCULATING PROPERTIES OF GASES AND GAS MIXTURES. *Petroleum Refiner*, 32, 125-128 (1953) June.

The viscosity and thermal conductivity of pure gases and gaseous mixtures can be predicted from charts as a function of temperature and pressure. The critical pressure, critical temperature, thermal conductivity at the critical, and viscosity at the critical are required. The necessary data at the critical are presented in a table for several pure gases and the molal average is used for a gaseous mixture.

W. W. Clauson

H_2S Equilibria

Brooks, A. A. A THERMODYNAMIC STUDY OF THE EQUILIBRIUM $2Cu(s) + H_2S(g) = Cu_2S(y) + H_2(g)$. *J. Am. Chem. Soc.*, 75, 7464-2470 (1953) May 20.

Equilibrium constants and free energies for this reaction were determined over the range 342 to 1037°C. Values of entropy and change in heat content are also given. D. M. Mason

Kinetics Computations

Perry, R. H. and Pigford, R. L. KINETICS OF GAS-LIQUID REACTIONS: SIMULTANEOUS ABSORPTION AND CHEMICAL REACTION. *Ind. Eng. Chem.* 45, 1247-1253 (1953) June.

By using a digital computer, solutions for the second-order differential equations of chemical kinetics involving transient accumulation, diffusion, and reaction terms have been obtained for gas absorption accompanied by chemical reaction in the liquid. The results are found to be in accord with experiment. The results, represented as the ratio of the local mass transfer coefficient with reaction to that without, are found to depend on the ratio and chemical equilibrium constants, the ratio of reactants, and the time of exposure of the liquid surface.

B. E. Eakin

Methane Combustion

Hoare, D. E. REPRODUCIBILITY IN THE SLOW COMBUSTION OF METHANE. *Faraday Soc. Trans.* (British), 49, 628-629 (1953) June.

Four different methods of obtaining reproducible results in the combustion of methane are reported. Differently-shaped curves and different kinetic laws are obtained. It is suggested that hydrogen atoms may be adsorbed by the surface during the combustion of methane in silica vessels. Author's Abstract

Molecular Energies

Evett, A. A. and Margenau, H. THE FORCES BETWEEN HYDROGEN MOLECULES. *Phys. Rev.*, 90, 1021-1025 (1953) June 15.

Earlier calculations of the H_2-H_2 interaction, based on the use of screening-constant functions, seemed to lead to reasonable answers only with the use of a nuclear charge much greater than the correct value for the isolated molecular, $Z_0 = 1.166$. The present work is a recalculation of the exchange forces for $Z = Z_0$. A small numerical error in the earlier work is elimi-

nated, and the exchange energy, instead of being slightly negative as reported previously, is actually positive. This removes all perplexing features from the problem and yields results in substantial agreement with experiments. The total interaction, consisting of exchange, van der Waals and quadrupole energies, is plotted for different relative orientations of the molecules in Fig. 2. A weighted average over all orientations is shown in Fig. 3 and compared with the semi-empirical curve of Hirschfelder, Bird, and Spotz, which was derived by fitting viscosity data. Authors' Abstract

Oxygen Production

Martin, H. Z. (assigned to Standard Oil Development Co.) PRODUCTION OF OXYGEN. U. S. 2,642,340 (1953) June 16.

The patent relates to a method of producing oxygen via a metallic acceptor in a fluidized bed which is subsequently increased in temperature to liberate free oxygen in a second fluidized zone. C. G. von Fredersdorff

Raman Spectra

Claassen, H. H. and Nielsen, J. R. A RAMAN APPARATUS FOR GASES. *J. Opt. Soc. America*, 43, 352-355 (1953) May.

A Raman irradiation apparatus designed for gaseous samples has been built. It is of simple construction, using aluminum foil wrapped around a single mercury arc and Raman tube to concentrate the light. The fundamentals of both O_2 and N_2 in a sample of air at eight atmospheres were photographed in an exposure of one and a half hours. Spectra of gaseous fluoroform and ammonia are presented.

Author's Abstract

Rate and Reactions

Wilhelm, R. H. RATE THEORY AND HOMOGENEOUS REACTIONS. *Ind. Eng. Chem.*, 45, 849-897 (1953) May.

A review of the literature on reaction rate calculations, pyrolysis, free radical mechanisms, slow oxidations and liquid phase reactions is presented. C. G. von Fredersdorff

Sulfur-Methane

Nabor, G. W. and Smith, J. M. KINETICS OF THE SULFUR-METHANE REACTION. *Ind. Eng. Chem.*, 45, 1272-1281 (1953) June.

A second order rate equation was obtained for the heterogeneous catalytic reaction of sulfur with methane which correlated with the experimental data. A method is presented where the conversion due to the reaction in the homogeneous phase may be eliminated, as reaction in both phases occurred. S. Mori

Thermal Conductivity

Silverman, L. THERMAL CONDUCTIVITY DATA PRESENTED FOR VARIOUS METALS AND ALLOYS UP TO 900°C. *J. Metals*, 5, 631-632 (1953) May.

Experimental thermal conductivity data from room temperature to 900°C are presented for 18 metals and alloys used in the electron tube industry. Experimental data are relative to that of lead which was chosen as primary standard. D. C. Gami

Thermodynamics

Smith, J. M. THERMODYNAMICS. *Ind. Eng. Chem.*, 45, 963-968 (1953) May.

A review of the literature on equations of state, thermodynamic properties, phase equilibria and chemical reactions is given.

G. von Fredersdorff

9. ORGANIC CHEMISTRY

Acetylene

Bordenca, C. ACETYLENE ITS PRODUCTION AND USES. *Can. Chem. Processing*, 37, 58, 60 (1953) July.

A brief summary of the more important acetylene processes and acetylene derived chemicals is given. J. M. Reid

Bour, R. C. (assigned to National Cylinder Gas Co.) METHOD OF REMOVING ACETYLENE FROM GASEOUS MIXTURES. U. S. 2,642,956 (1953) June 23.

The use of phosphoric acid esters of less than six carbon atoms such as trimethyl phosphate as a solvent for the extraction of acetylene from hydrocarbon gas mixtures is described. High

acetylene adsorption, high boiling point, and no reaction with olefins or other unsaturates is claimed. J. M. Reid

Gilbert, H. N. (assigned to E. I. du Pont de Nemours and Co.) PRODUCTION OF SODIUM CARBIDE AND ACETYLENE. U. S. 2,642,347 (1953) June 16.

A method of producing sodium carbide by the reaction of sodium with carbon monoxide at 600° to 850°C is described. A mixture of sodium carbide, 20 to 40 per cent by weight and sodium carbonate is produced. Treating the mixture with steam or water yields acetylene gas and caustic soda as a by-product.
J. M. Reid

Alcohol Synthesis

Mertzweiller, J. K. and Parker, P. T. (assigned to Standard Oil Development Co.) CATALYTIC SYNTHESIS OF ALCOHOLS. U. S. 2,641,613 (1953) June 9.

Inorganic salts of cobalt, such as chloride, nitrate and sulfate may be used to catalyze the reaction between carbon monoxide, hydrogen and olefine to give aldehyde or other oxygenated compounds. The inorganic salt is dissolved in a small quantity of product and added to the feed. The inorganic salt is recovered and reused. H. A. Dirksen

Ethane Chemicals

Stark, D. J. NATURAL GAS TO ETHANE TO ETHYLENE. *Petroleum Processing*, 8, 897-899 (1953) June.

A plant designed to extract ethane from 425 MMCF/day of natural gas, convert it to ethylene by cracking, and subsequently produce 1,130,000 gallons of ethanol and 137,000 pounds of ethyl chloride is described in detail. Located in Tuscola, Illinois at the junction of two major transmission lines, gas is withdrawn, oil scrubbed at low temperature to remove ethane and higher components and returned to the pipe line. The plant is self-contained with its own sulfuric acid plant, power generation equipment and water purification facilities. J. M. Reid

Extractive Crystallization

Francis, A. W. SEPARATION OF HYDROCARBONS AND HYDROCARBON DERIVATIVES. Gorin, E. SEPARATION OF HYDROCARBONS AND HYDROCARBON DERIVATIVES. Gorin, E. UREA-OLEFIN COMPLEXES. Gorin, E. and Kinney, R. E. METHOD OF SEPARATING HYDROCARBONS WITH THIOUREA. (assigned to Socony-Vacuum Oil Co., Inc.) U. S. 2,642,421; 422; 423; 424 (1953) June 16.

These patents describe processes, closely related to solvent extraction, in which hydrocarbon mixtures are treated with urea or thiourea to selectively form complex crystalline compounds. These complexes may be recovered, then separated into their components by heating, or by adding water or an organic solvent. It is claimed that previous "plexation" procedures are now improved by using aqueous acetic acid solutions as solvents for the urea or thiourea. The process is applicable to the separation of many organic compounds, such as isomeric branched aliphatic hydrocarbons from related straight chain compounds, cycloparaffins and cyclo-olefins from hydrocarbon fractions, monoolefins from paraffins and polyolefins, singly substituted from multiply substituted compounds where the substituents may be halogens, or groups containing nitrogen, sulfur or oxygen. The extent to which many compounds may be complexed is correlated with the "length" and "width" of any substituted groups, with chain length, and with double bond location.
E. B. Shultz, Jr.

Olefin Synthesis

Garner, P. J. and Miles, S. E. (assigned to Shell Development Co.) PRODUCTION OF OLEFINIC HYDROCARBONS. U. S. 2,642,466 (1953) June 16.

An improvement is claimed in the process of producing aliphatic olefins from paraffinic waxy hydrocarbons by vapor phase chemical cracking. By thermal soaking the feed, or feed and recycle stock for 15 minutes to 4 hours at 390°-450° C, the amount of residue left after the flash vaporization step is reduced to from 1/20 to 1/10 of the feed which increases the overall efficiency of the process. J. M. Reid

Oxygen Economics

Sherwood, P. W. THE USE OF OXYGEN IN THE PETROCHEMICAL INDUSTRY. *Petroleum Refiner* 32, 90-94 (1953) June.

In almost every case where oxygen is used in the petrochemical industry, competitive methods are available. Oxygen does present chemical and thermal advantages and when nitrogen is absent from the reaction system, the use of oxygen must be based on economic balances for the installation under consideration. Tonnage oxygen of 95-98 per cent purity is more economical in large installations than the Linde cycle. G. V. Vosseller

Phenol Synthesis

Saunders, R. H. (assigned to Hercules Powder Co.) PHENOL PRODUCTION. U. S. 2,644,014 (1953) June 30.

A process is claimed by which alpha-hydroxy or alpha-or beta-unsaturated alkyl-substituted aryl compounds are oxidized by means of a suitable reagent to a phenol or cresol. W. J. Pleticka

PHENOL AND ACETONE VIA CUMENE OXIDATION. *Can. Chem. Processing*, 37, 50, 52 (1953) May.

A new plant to produce phenol and acetone from propane-propylene and benzene is described. Propane and propylene are alkylated with benzene at 200 psi and 400° F over sulfuric acid catalyst to give cumene which is subsequently oxidized to cumene hydroperoxide and split into phenol and acetone. Thirteen million pounds of phenol and eight million pounds of acetone will be produced annually, the total domestic requirements for Canada. A unique feature of the plant is the entirely out-of-doors construction, which requires over 20 miles of steam-pipe lagging to permit operation in the Canadian winter climate. J. M. Reid

Reforming

Berger, C. V. and Haensel, V. (assigned to Universal Oil Products Co.) CATALYTIC REFORMING OF HYDROCARBONS. U. S. 2,642,385 (1953) June 16.

The addition of water to the reforming reaction reduces the carbonaceous deposit associated with platinum or palladium catalysts and permits continuous operation with little effect on the end product. H. A. Dirksen

Styrene

Sherwood, P. W. STYRENE — ANOTHER PROMISING PETROCHEMICAL. *Petroleum Processing* 3, 724-728, May; 902-906 (1953) June.

Two methods of producing styrene from ethylbenzene are described. The dehydrogenation of ethylbenzene gives yields of 86-87%, but separation of the monomer presents problems. While the oxidation process yields only 80-82%, the acetophone by-product with simpler separation make this process more attractive.

W. J. Pleticka

Sulfur Reactions

Hauser, C. R., Kantor, S. W. and Brasen, W. R. REARRANGEMENT OF BENZYL SULFIDES TO MERCAPTANS AND OF SULFONIUM IONS TO SULFIDES INVOLVING THE AROMATIC RING BY ALKALI AMIDES. *J. Am. Chem. Soc.*, 75, 2660?-2663 (1953) June 5.

Certain benzyl sulfides and sulfonium ions were rearranged by alkali amides to form mercaptans and sulfides, respectively. Determination of the structures of the products showed that the type of rearrangement realized involved substitution at the ortho position of the benzene ring like that observed previously with benzyl quaternary ammonium ions.

Author's Abstract

Synthetic Rubber

Tracy, O. V. BUTADIENE: AN ORGANIC BUILDING BLOCK. *Oil Gas J.*, 52, 299-306 (1953) July 27.

A review of anticipated market demand and present capacities for butadiene is presented.

W. J. Pleticka

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

COAL HYDROGENATION CHEMICALS PLANT. p. 157

NABOR, G. W. KINETICS OF THE SULFUR-METHANE REACTION. p. 167

10. CHEMICAL ENGINEERING

Exchanger Costs

Rubin, F. L. PRESSURE, TEMPERATURE, ALLOYS. *Chem. Eng.*, **60**, 177-181 (1953) July.

Relative shell and tubing exchanger costs are tabulated for a wide range of pressures and heat exchange areas. Prices are also given for different steels used in construction of the exchangers. W. G. Bair

Gas-Solids Separator

Berg, C. H. O. (assigned to Union Oil Co.) GAS-SOLID SEPARATOR. U. S. 2,641,335 (1953) June 9.

A gas-solid separator is described which is composed of a large chamber with gas-solids inlet at the top and solids outlet at the bottom. The particle size of the solids may be controlled by changing the exit velocities of the gas phase by means of a manifold and valve arrangement. The invention could be applied to a fluid process in which particle size control was critical.
W. G. Bair

Heat Transfer

Herden, C. van, Nobel, A. P. and van Krevelen, D. W. MECHANISM OF HEAT TRANSFER IN FLUIDIZED BEDS. *Ind. Eng. Chem.*, **45**, 1237-1242 (1953) June.

The authors propose a mechanism for heat transfer in fluid beds which is dependent on the conductivity and motion of the individual particles. They show that if the conductivity of the particles was allowed to become very small without changing the other physical properties, the heat transfer rate would approach the rate for fixed beds. An anologous relation is developed for mass transfer. W. G. Bair

Packed-Bed Flow

Schwartz, C. E. and Smith, J. M. FLOW DISTRIBUTION IN PACKED BEDS. *Ind. Eng. Chem.*, **45**, 1209-1218 (1953) June.

Velocity measurements made at varying radial distances from the center of a packed column with a hot wire anemometer indicate that uniform conditions of flow do not exist over the entire area of a packed bed. Data were obtained from 2-, 3-, and 4-inch pipes using $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ inch spherical and cylindrical pellets. A peak velocity was found to exist approximately one pellet distance from the tube wall, ranged from 30 to 100 per cent greater than the velocity at the center of the tube for ratios of D tube/D pellet of less than 30. The experimental results are presented in tabular and graphical form.
J. M. Reid

Storage Losses

Prater, N. H. and Huff, R. M., Jr. EVAPORATION LOSSES . . . AND AN ECONOMIC ANALYSIS OF EQUIPMENT FOR RECOVERING VAPORIZED HYDROCARBONS, BY TWO GULF COAST ENGINEERS. *Oil Gas J.*, **52**, 178-180, 183 (1953) June 22.

Various factors which influence the evaporation losses in a fixed-roof storage tank are discussed.
D. C. Gami

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Precision Pump

Sheen, R. T. and Fell, A. D. CONTROLLED VOLUME PUMPING OF MINUTE FLOWS. *Chem. Eng. Progress*, **49**, 299-302 (1953) June.

A pump of new design, operating in the range of 3 to 3000 milliliters per hour is presented. It transfers liquids with instrumental accuracy against pressures from atmospheric to as high as 1000 psi. Speeds may vary from one to 100 strokes per minute (one inch maximum stroke) with either a $\frac{1}{8}$-in. or $\frac{1}{4}$-in. diameter plunger. The unit is precision cast of Carpenter No. 20 stainless steel, and may be furnished with several types of pneumatic, electric, or gas engine drives. E. B. Shultz, Jr.

Pressure Gage

Shuffler, R. M. MEASURING PRESSURES ELECTRONICALLY. *Petroleum Eng.* **25**, D-96-98 (1953) May.

A description of the application of a strain gage to pressure measurement. These instruments

are said to be capable of measuring pressure transients with airwave fronts corresponding to 20,000 cps and are applicable to the measurement of transients in pipeline and compressor stations. R. F. Bukacek

Pressure Seals

Niemeier, B. A. SEALS TO MINIMIZE LEAKAGE AT HIGHER PRESSURE. *Am. Soc. Mech. Engs. Trans.*, **75**, 369-379 (1953) April.

Fixed and moving seals to be used in the superpressure range, 10,000 to 100,000 psi, as classified by the author, are studied and evaluated. A general discussion of the theoretical problems in confining pressures of great magnitude precedes methods for designing seals for such pressures. A method and device for evaluating seals has been developed to provide confirmation of theories. Practical seal problems and applications are shown. Author's Abstract

Pumps

Foster, J. S., Jr., Lawrence, E. O. and Lofgren, E. J. A HIGH VACUUM HIGH SPEED ION PUMP. *Rev. Sci. Instr.*, **24**, 388-390 (1953) May.

A vacuum pump based on the properties of a magnetically collimated electric discharge is described. It has a speed in the range 3000 to 7000 liters a second and a base pressure of the order of 10^{-6} mm. D. V. Kniebes

Refractories

Norton, C. L., Jr. REFRACTORIES FOR EVERY USE. *Chem. Eng.*, **60**, 216-220 (1953) June.

Various types of refractories are described as to composition, melting points, approximate costs per 1000 sq ft and normal temperature-use limits. Insulating bricks, castable refractories, and plastic refractory mixes are tabulated. A table of special compounds with reported melting points above 4000°F is included. B. E. Eakin

Recording Hygrometer

Deaton, W. M. CONTINUOUS MEASUREMENT OF WATER VAPOR IN NATURAL GAS ACHIEVED WITH NEW RECORDER. *Gas*, **29**, 100, 102, 104 (1953) June.

This commercially available instrument is comprised of an electric hygrometer and a recording unit, with means for maintaining the hygrometer at selected constant temperatures. The hygrometer is suitable for use with natural gases at pressures up to 2,500 psig, having dew points not lower than -20°F. Construction of the hygrometer element is described, and a discussion of its sensitivity to temperature, pressure and various vapors is included. C. E. Hummel

Valves

Brockett, G. F. SELECTION OF CONTROL VALVES. *Instruments*, **26**, 893-896 (1953) June.

Some practical considerations in the selection of control valves are discussed. Factors considered include body design and construction, materials of construction, stuffing box and packing material, choice of inner valve, valve operator and valve positioners. E. J. Pyrcioch

Waste Treatment

Brien, E. B. LOW COST, WASTE WATER CLEANER. *Petroleum Eng.*, **25**, C25-C29 (1953) June.

A compact, low cost system for removing oil, grease, and suspended solids from waste water is described. Increased flotation activity is promoted by injecting 1 to 2% air into the suction side of the waste-water pump. In a flotation tank the dissolved air comes out of solution in colloidal dispersion and assists in forming a relatively high density suspensoid float which is removed from the surface by a series of scrapers. Water containing up to 5000 ppm of foreign matter can be reduced to 25 ppm at the rate of 1,000,000 gallons per day in a tank which measures only 35 x 9½ x 6 feet. J. M. Reid

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Proper, G. AUTOMATIC SHUTDOWN DEVICES ON GAS PIPE LINES. p. 159

12. MATERIALS OF CONSTRUCTION

Hydrogen Attack

Bonner, W. A., Burnham, H. D., Conradi, J. J. and Skei, T. PREVENTING HYDROGEN ATTACK ON STEEL. *Petroleum Proc.*, 8, 686-690, May; 878-884, June (1953); *Oil Gas J.*, 52, 100-103, 130, 131 (1953) June 8.

The use of modern refining processes and the greater handling of sour hydrocarbons have increased the vulnerability of steel equipment in refineries to attack by atomic hydrogen released by acid corrosion of the steel. Extensive damage thru blistering and fissuring can be sustained. The methods of detecting hydrogen penetration, conditions necessary for attack to occur, and possible methods for controlling hydrogen penetration, that have been field tested are explained. Laboratory experiments on the effectiveness, and the possible mechanism for action of polysulfide in stopping hydrogen penetration are reported. Plant experience with polysulfide and oxygen injection are detailed, and a permanent plant installation for control of hydrogen penetration is presented.

B. E. Eakin

Inhibitors

Wormwell, F. CORROSION INHIBITORS IN NEUTRAL AQUEOUS SOLUTIONS. *Chem. and Ind.* (British), 23, 556-560 (1953) June 6.

The article reviews work done by the Chemical Research Laboratory, Teddington, on antifreeze inhibitors of the glycol type. Laboratory and field tests were concerned with applications of sodium benzoate, and other sodium organic salts as corrosion inhibitors for mild steel. Some conclusions are drawn regarding the mechanism of corrosion inhibition. W. J. Pleticka

Pipeline Sleeves

Grable, G. B. and McClure, G. M. HOW WELL DO GIRTH WELD SLEEVES RESIST LOADING AND BENDING STRESSES. *Gas*, 29, 87-89 (1953) June.

Sections of thin wall 26 in. pipe were tested to rupture under pressure and bending moment to test the effectiveness of girth sleeves. The conclusions favor no sleeves unless to reinforce defective joints under conditions of static loading with no bending stresses. B. E. Eakin

Reflecting Paint

Gerbes, O. REDUCE EVAPORATION DURING STORAGE . . . TESTS ON GULF COAST DEMONSTRATE ITS UTILITY. *Oil Gas J.*, 52, 286, 288-291, 293 (1953) June 22.

Data are presented herein demonstrating that at Gulf Coast conditions, use of white paint on a double-deck floating-roof tank prevents boiling of 13.3 psi. R.v.p. natural gasoline with its attendant high loss rate and in addition permits storage of 16 psi R.v.p. natural gasoline without high loss. This increased utility for low-pressure storage represents a large return on the incremental cost of the white paint where the operator is confronted with the alternatives of purchasing the relatively more expensive pressure-type storage such as a spheroid or of taking a high loss in the summer. Additional data are presented such as pertinent temperature measurements which are expected to be of value to technical personnel.

Author's Abstract

Weld Inspection

Gobus, A. HOW TO CUT WELD INSPECTION TIME. *Petroleum Eng.*, 25, C21, C24 (1953) June.

A new inspection method which utilizes a water-cooled film casette permits taking a radiograph of hot welds without cooling and reheating cycles, reducing the total weld time as much as 55%. B. E. Eakin

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Nelson, J. W. PREVENTION OF CORROSION. p. 161

Silverman, L. THERMAL CONDUCTIVITY FOR VARIOUS METALS AND ALLOYS. p. 167

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